The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

PRIORITY DOCUMENT

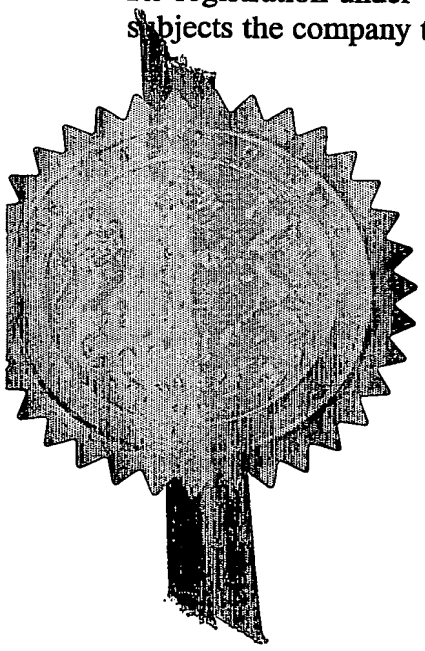
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed Stephen Hurdle.

Dated 22 August 2003

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

THE PATENT OFFICE
B
- 8 AUG 2002
NEWPORT

1/77

P01/7700 0.00-0218339.0

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference — TORQUE TIGHTENING WRENCH

2. Patent application number *(The Patent Office will fill in this part)* — 0218339.0 — 08 AUG 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

SMART TOOLS LTD.,
BADON POWER RD.,
KIRKTON IND. EST.,
ARBROATH,
ANGUS.
DD11 3LS

08071102002

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

TORQUE TIGHTENING WRENCH

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

NEIL BUCHANAN,
BEECHTREE COTTAGE,
NEW GILSTON,
BY LEVEN
FIFE

RGC Jenkins & Co.
26 Caxton Street
LONDON
SW1H 0RJ

Patents ADP number *(if you know it)*

03966736001

FS1/77

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
—		

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*
—	

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or

b) there is an inventor who is not named as an applicant, or

c) any named applicant is a corporate body.

See note (d))

—

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	15
Claim(s)	2
Abstract	1
Drawing(s)	7 + 7 + 7

10. If you are also filing any of the following, state how many against each item.

Priority documents	—
Translations of priority documents	—
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	—
Request for preliminary examination and search *(Patents Form 9/77)*	—
Request for substantive examination *(Patents Form 10/77)*	—
Any other documents *(please specify)*	—

11. ~~I~~/We request the grant of a patent on the basis of this application.

Signature [signature] Date 7/8/02

12. Name and daytime telephone number of person to contact in the United Kingdom Nicola Buchanan 01334 840381

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) For details of the fee and ways to pay please contact the Patent Office.

TORQUE TIGHTENING WRENCH

FIELD OF THE INVENTION

The present invention relates to wrenches (also known as 'spanners', particularly in the United Kingdom), and in particular to " ring" wrenches.

BACKGROUND OF THE INVENTION

A Wrench is a tool for applying torque to a nut, bolt, screw or the like (hereinafter referred to, for convenience, as a " fastener") for the purpose of tightening or slackening the fastener. The wrench has a head portion shaped to engage the periphery of the fastener in a non-rotatable manner such that a force applied to rotate the head transmits torque to the fastener. The fastener generally has a polygonal shape, typically hexagonal or square, and the head of the wrench has a complementary shape and size. The head of a ring wrench is configured to substantially surround the periphery of the fastener.

The following description will refer particularly to wrenches for use with hexagonal nuts. However, it will be understood that the invention is equally applicable to wrenches and corresponding nuts having other shapes and to other types of fastener such as bolts and screws.

A conventional ring wrench has a ring-shaped head with a hexagonal shaped inside surface, each section of which can be substantially flat. In use the inside surface of the wrench engages the flat surfaces or corners of the nut to be tightened or slackened. When the head is rotated in the appropriate direction the nut is slackened or tightened as required. However if the nut is undersized, damaged or worn, it is very likely that the head will 'slip' and rotate around the nut instead of properly gripping or engaging the flats or corners of the nut.

A further embodiment of the present invention applies to a ratchet bar tool used for applying torque via an attached square drive and appropriate socket to a nut, bolt or screw (hereinafter referred to a fastener) for the purpose of tightening or slackening the fastener. The ratchet bar is movable relative to the socket in one direction only. Motion between the ratchet bar and the socket in the opposite direction is prevented by a set of angular teeth, which co-operate with a resilient pawl so as to create a locking motion in one direction only and free movement in the opposite direction. This operation of the socket and fastener via a ratchet bar is much more convenient in restrictive situations than the use of a fixed bar operated socket as there is seldom a requirement to remove and reattach the socket operating the fastener.

Variations of the ratchet bar are exhaustive. Most mechanisms have more and more locking teeth etc. to allow a smaller angle between drive, reposition and

drive, resulting in mechanisms that whilst the angle between drive and reposition has been substantially reduced so has the amount of torque that can be safely applied to the ratchet bar without failure.

Summary of the Invention

It is an object of the present invention to provide an improved wrench with which fasteners that are undersized, damaged or worn can be reliably engaged by the wrench for applying a torque thereto.

In accordance with the invention there is provided a wrench having a head portion adapted to engage and apply torque to a fastener, said head portion including a flexible ring portion having an inner working surface for engaging the fastener, such that, when a torque is applied to said head in a predetermined direction, said ring portion closes around said fastener.

Preferably, said head portion is adapted to engage and apply torque to a fastener, said head portion including a ring member adapted to substantially surround a peripheral surface of a fastener such that, when an inner surface of said ring member engages a fastener and a torque is applied to said head portion in a predetermined direction, said ring member closes around said fastener.

Said wrench further includes converging slots in the head portion which converge towards the ring member and slot pins within the converging slots which are in fixed positions relative to the handle portion.When the said inner surface of said ring member engages said fastener or drive means such as a spigot on a socket drive and said torque is applied to said head portion in said predetermined direction, said fixed cam pins within said converging slots pivoting in the direction of the said torque.

In one example if the said torque is applied in the ' clockwise direction' the said cam pins will also rotate in a clockwise direction within the said converging slots. Viewed from above with the handle portion towards the operator the left hand cam pin is prevented from further travel in a 'clockwise direction' by the left hand converging slots top inner the said pin becoming a fixed pivot point. The 'right hand' cam pin can however travel within the 'right hand' converging slot towards the bottom outer. The consequence of the said cam pin travelling towards the bottom outer is the said ring member closes around the said fastener or drive means until such times as no further closure can be attained. All further turning force applied to the torque tightening wrench is then transmitted directly to the fastener in order to operate the fastener as required.

When the torque-tightening wrench is operated in the opposite anti-clockwise direction the said cam pins will also rotate in an anti-clockwise direction

within the said converging slots. Viewed from above with the handle portion towards the operator the 'right hand' cam pin is prevented from further travel in a clockwise direction by the 'right hand' converging slot top inner. The said pin becoming a fixed pivot point. The 'left hand' cam pin being propelled within the 'left hand' converging slot towards the bottom outer. The consequence of the said cam pin travelling towards the bottom outer is the said ring member closes around the fastener or drive means until such times as no further closure can be attained. All further turning force applied to the torque tightening wrench is then transmitted directly to the fastener or drive means in order to operate the fastener or drive means as required.

Description of the embodiments

Specific embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1a shows in perspective the torque-tightening wrench wherein the head portions are preferably stacked on the top of each other in order to provide a range of wrenches in a convenient package.

Figure 1b illustrates in perspective the torque-tightening wrench with one head portion on each end of the handle portion.

Figure 2a shows a side view of the torque-tightening wrench wherein the head portions are preferably conveniently stacked on the top of each other.

Figure 2b illustrates a side view of the torque-tightening wrench.

Figure 3a illustrates a top view of the torque-tightening wrench engaging a fastener in the clockwise © drive (D) direction.

Figure 3b shows a top view of the torque-tightening wrench at rest.

Figure 3c shows a top view of the torque-tightening wrench engaging a fastener in an anti-clockwise (A) drive (D) direction.

Figure 4a illustrates a top view if the torque tightening wrench wherein circular drive sockets are within the circular inner ring. The bottom head portion is shown biased in the anti-clockwise (A) drive (D) direction.

Figure 4b illustrates a top view of a torque-tightening wrench wherein the drive portions have square drives.

Figure 4c shows a top view of a torque-tightening wrench wherein circular drive sockets are within the circular inner ring. The bottom head portion is shown biased in the clockwise (C) drive (D) direction.

Figure 5a illustrates a top sectioned view of the torque-tightening wrench as in Fig 4a.

Figure 5b illustrates a top sectioned view of the torque-tightening wrench as in Fig 4b.

Figure 5c shows a top sectioned view of the torque-tightening wrench as in Fig 4c.

Figure 6a shows a sectioned perspective view of the torque-tightening wrench as in Fig 3a.

Figure 6b shows a sectioned perspective view of the torque-tightening wrench as in Fig 3b.

Figure 6c illustrates a sectioned perspective view of the torque-tightening wrench as in Fig 3a.

Figure 7 illustrates the torque-tightening wrench wherein circular drive sockets are within the circular inner ring. A fastener is shown within a drive socket. The torque-tightening wrench is biased by the use of thumb and finger grip. A circular drive socket is shown seperately with its circular drive portion exposed.

REFERENCE TO THE DRAWINGS

With reference to the accompanying drawings the following numbers relate to the following features:

(1)	Torque tightening wrench	**(4c)**	Head Slot
(2)	Head portion	**(5)**	Connecting plates
(2a)	Resilient ring member	**(6)**	Fastener
(2b)	Converging slots	**(7)**	Circular drive portion
(2c)	Top cam surface	**(7a)**	Circular drive socket
(2d)	Bottom cam surface	**(7b)**	Circular drive recess
(2e)	Elongate member	**(7c)**	Circular drive retaining ring
(2f)	Torque gap	**(7d)**	Circular drive square drives
(2g)	Polygonal inner surface	**(8)**	Resilient cam
(2h)	Ring segments	**(8a)**	Spring
(2i)	Concave corner hinges	**(8b)**	Ball
(2j)	Circular inner ring	**(9a)**	Thumb
(2k)	Bias profile	**(9b)**	Fingers
(3a)	Slot cam pins	**(A)**	Anti-clockwise direction
(3b)	Handle pins	**(C)**	Clockwise direction
(4)	Handle portion	**(D)**	Drive
(4a)	Handle cover grip	**(R)**	Reverse or reposition
(4b)	Resilient cam recess		

REFERENCE TO THE DRAWINGS

Referring to the drawings the torque tightening wrench (1) comprises a head portion (2) with a resilient ring member (2a) with converging slots (2b) with top cam surfaces (2c) nearest the resilient ring member (2a) and bottom cam surface (2d) within the elongate members (2e). The open resilient ring member (2a) has a torque gap (2f) within the resilient ring member (2a) and in one example a polygonal inner surface (2g) with ring segments (2h) joined by concave corner hinges (2i). At rest, the slot cam pins (3a) are preferably against the top cam surfaces.

When the torque tightening wrench (1) engages a fastener (6) and torque arm force is applied to the handle portion (4) in a predetermined drive (D) direction (either clockwise (C) or anti-clockwise (A)) the head portion (2) polygonal inner surface (2g) grips the fastener (6) by its like surfaces. The slot cam pins (3a) affixed to the handle portion (4) rotate in the like direction of the torque arm force. As one slot cam pin (3a) can no longer rotate within its converging slot as it has attained full movement against its top cam surface it becomes a fixed point around which the head portion (2) can pivot. Whereas,

the other slot cam pin (3c) can, according to the torque arm force applied, travel outwards from the resilient ring member (2a) towards the bottom cam surface (2d) causing the resilient ring member (2a) and its polygonal inner surface (2g) to close around the fastener (6) providing superior grip to the nearsized, undersized, worn or damaged fasteners (6) allowing a far greater range of fasteners (6) to be appropriately tightened or slackened as required. The head portion (2) can rotate horizontally relative to the handle portion (4) within the confines of the head portion slot (4c) or connecting plates (5) fixed to the handle portion (4) by the handle pins (3a) a handle cover grip (4a) can be usefully provided to improve comfort during use.

In a further embodiment of the present invention, the resilient ring member (2a) has a circular inner ring (2j) for the engagement of a resilient gripped circular drive portion (7) which can conveniently drive directly or otherwise various known sockets or fastener (6) drives or circular drive square drives (7d). A circular drive socket (7a) preferably has a circular drive recess (7b) or retaining ring (7c). In one example, the head portion (2) is preferably first biased in the drive (D) direction the preferably resilient cam (8) ball (8b) is sprung by a spring (8a) from the resilient cam recess (4b) against the bias profile (2k) on the elongate member (2e). The bias imported by the resilient cam (8) acting predominantly against the elongate member (2e) containing the

non-pivotal slot cam pin (3a). The resilient cam (8) and the resilient ring member (2a) with the circular inner ring (2j) import a resilient grip on the drive portion (7). In the drive (D) direction the grip between the circular inner ring (2j) and the drive portion (7) is virtually instant. When the handle portion (4) is operated in the reverse or reposition (R) direction the applied torque arm force acts against the resilient cam (8) and the resilient grip applied by the resilient ring member (2a) substantially decreasing the degree of clamping between the circular inner ring (2j) and the drive portion (7) enabling the head portion (2) to easily rotate, reverse or reposition (R) relative to the drive portion (7). The drive portion (7) can conveniently form part of a circular drive socket (7a) which preferably has a circular drive recess (7b) or a circular drive retaining ring (7c).

In use the Torque Tightening Wrench (1) head portion (2) engages the fastener (6) or circular drive means (7) to be operated. In the first example the polygonal inner surface (2g) engaging the like sized and shaped fastener (6). In the second example the circular inner ring (2j) engaging the drive portion (7). The slot cam pins (3a) fixed to the handle portion (4) initial position is preferably against the top of the converging slots (2b), the top cam surface (2c). As torque arm force is applied to the handle portion (4) the slot cam pins (3a) rotate in the same direction as the force applied to the handle portion (4).

As only one or other of the slot cam pins (3a) according to the direction of applied force (clockwise (C) or anti-clockwise A) is capable of movement within the converging slots (2b) the static slot cam pin (3a) becomes a pivot point. The progress of the disposition of the moveable slot cam pin (3a) up the incline of the further converging slot (2b) causing the elongate members (2e) to be drawn together to close the torque gap (2f) according to the torque arm force applied and the amount the resilient ring member (2a) closes around the fastener (6) or circular drive portion (7) until such times as no further closure can be attained. All further torque arm force applied to the torque tightening wrench (1) is then usefully transmitted directly to the fastener (6) or circular drive portion (7) in order to tighten or slacken the fastener (6) according to the direction of force. The first example of the torque tightening wrench (1) whereas the head portion (2) has ring segments (2h) defining a generally polygonal inner surface (2g) although not a complete ring the ring segments (2h) are formed integrally with one another and adapted to deform resiliently at the concave corner hinges (2I) between adjacent, integrally formed ring segments (2h) allowing the resilient ring member (2a) to close around the fastener (6). As torque is applied usefully enhancing the grip on worn or undersized fasteners (6).

In the second example of the torque tightening wrench (1) the resilient ring member (2a) has a circular inner ring (2J) which has a resilient grip on a

complementary circular drive portion (7). The circular drive portion (7) can take the form of removable circular drive sockets (7a) retained circular drive sockets (7a) or square drives (7d) or any combination. Instant grip can be imported on the circular drive portion (7) in the drive (D) direction by gripping the handle portion (4) appropriately by the hand whereas the thumb (9a) is placed as a pivotal point near the head portion(2) and the fingers (9b) import the main torque arm force. In the reverse (R) direction the pivotal action of the thumb (9a) is lessened. The circular drive portion (7) then being easily reversed or repositioned.

Abstract

Torque Tightening Wrench

The fastener (6) is engaged by the polygonal inner surface (2g) of the resilient ring member (2a) or circular drive portion (7). As force is applied to the handle portion (4) in the required direction slot cam pins (3a) fixed to the handle portion (4) rotate accordingly within converging slots (2b) within the head portion (2) elongate members (2e), causing the elongate members to be drawn together closing the resilient ring member (2a) around the fastener (6) or circular drive portion (7) until no further closure can be attained. All further force is then usefully transmitted to the fastener (6) in order to tighten or slacken the fastener (6) as required.

In use the wrench (1) resilient ring member (2a) and its polygonal inner surface (2g) closes around the fastener (6) providing superior grip to nearsized, worn or damaged fasteners and if the head portions (2) are stacked on top of each other a range of both metric and inch wrenches can be provided in a more convenient package.

Claims

Claim 1 The Torque Tightening Wrench (1) head portion (2) engages the fastener (6) or circular drive means (7) to be operated. In the first example the polygonal inner surface (2g) engaging the like sized and shaped fastener (6). In the second example the circular inner ring (2j) engaging the drive portion (7). The slot cam pins (3a) fixed to the handle portion (4) initial position is preferably against the top of the converging slots (2b), the top cam surface (2c). As torque arm force is applied to the handle portion (4) the slot cam pins (3a) rotate in the same direction as the force applied to the handle portion (4). As only one or other of the slot cam pins (3a) according to the direction of applied force (clockwise (C) or anti-clockwise A) is capable of further movement within the converging slots (2b) the static slot cam pin (3a) becomes a pivot point. The progress of the disposition of the moveable slot cam pin (3a) up the incline of the further converging slot (2b) causing the elongate members (2e) to be drawn together to close the torque gap (2f) according to the torque arm force applied and the amount the resilient ring member (2a) closes around the fastener (6) or circular drive portion (7) until such times as no further closure can be attained. All further torque arm force applied to the torque tightening wrench (1) is then usefully transmitted

directly to the fastener (6) or circular drive portion (7) in order to tighten or slacken the fastener (6) according to the direction of force. The first example of the torque tightening wrench (1) whereas the head portion (2) has ring segments (2h) defining a generally polygonal inner surface (2g) although not a complete ring the ring segments (2h) are formed integrally with one another and adapted to deform resiliently at the concave corner hinges (2I) between adjacent, integrally formed ring segments (2h) allowing the resilient ring member (2a) to close around the fastener (6). As torque is applied usefully enhancing the grip on worn or undersized fasteners (6).

In the second example of the torque tightening wrench (1) the resilient ring member (2a) has a circular inner ring (2J) which has a resilient grip on a complementary circular drive portion (7). The circular drive portion(7) can take the form of removable circular drive sockets (7a) retained circular drive sockets (7a) or square drives (7d) or any combination.

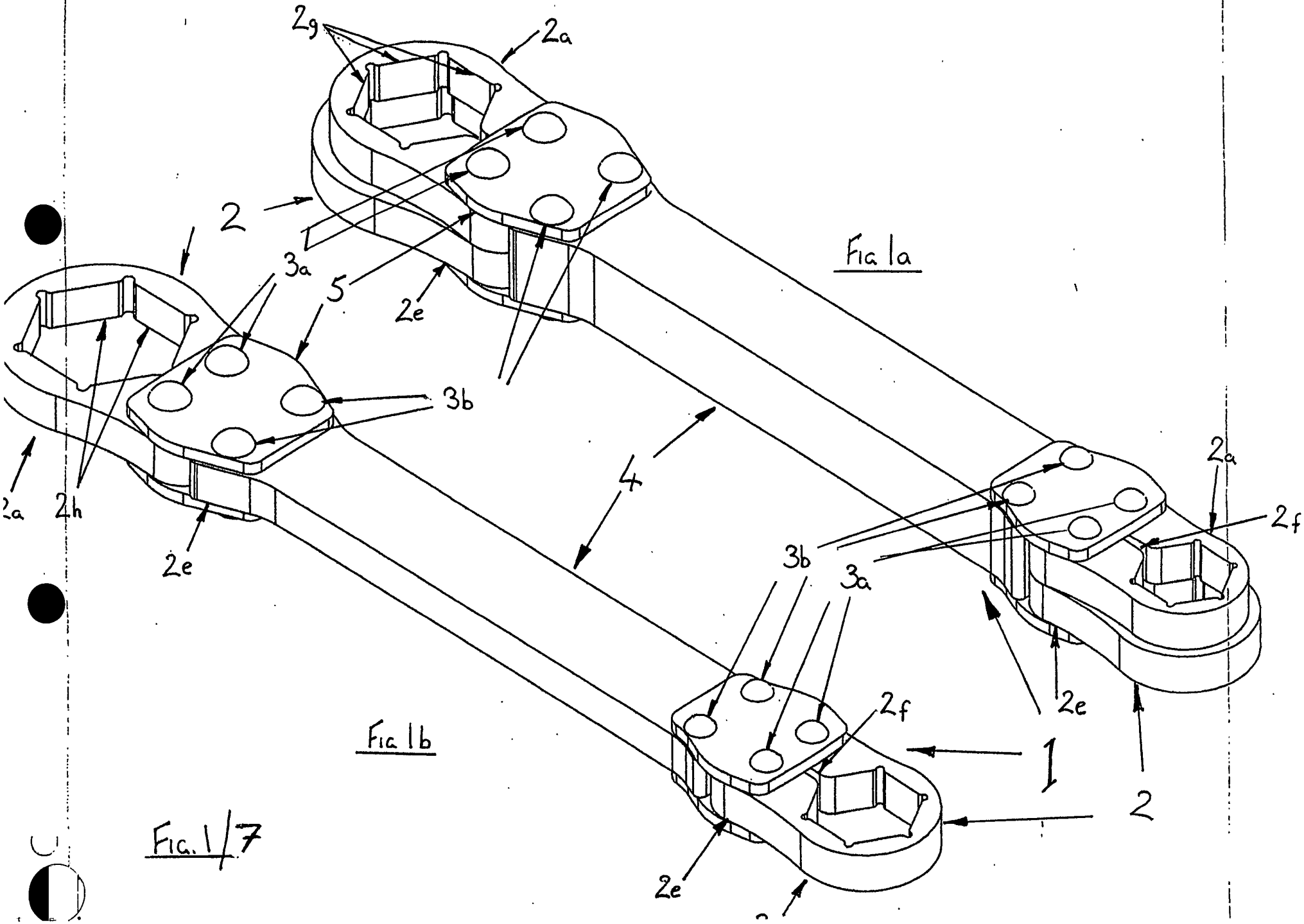


Fig 1a

Fig 1b

Fig. 1/7

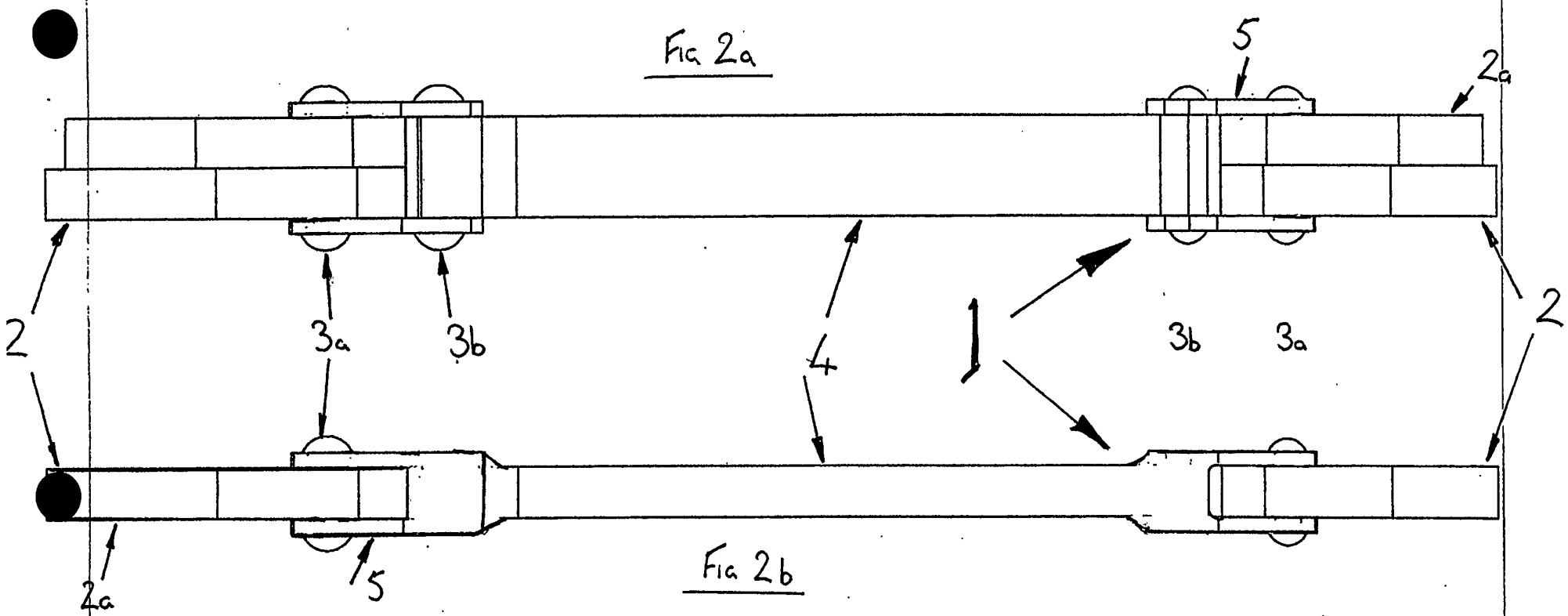


Fig 2a

Fig 2b

Fig. 2/7

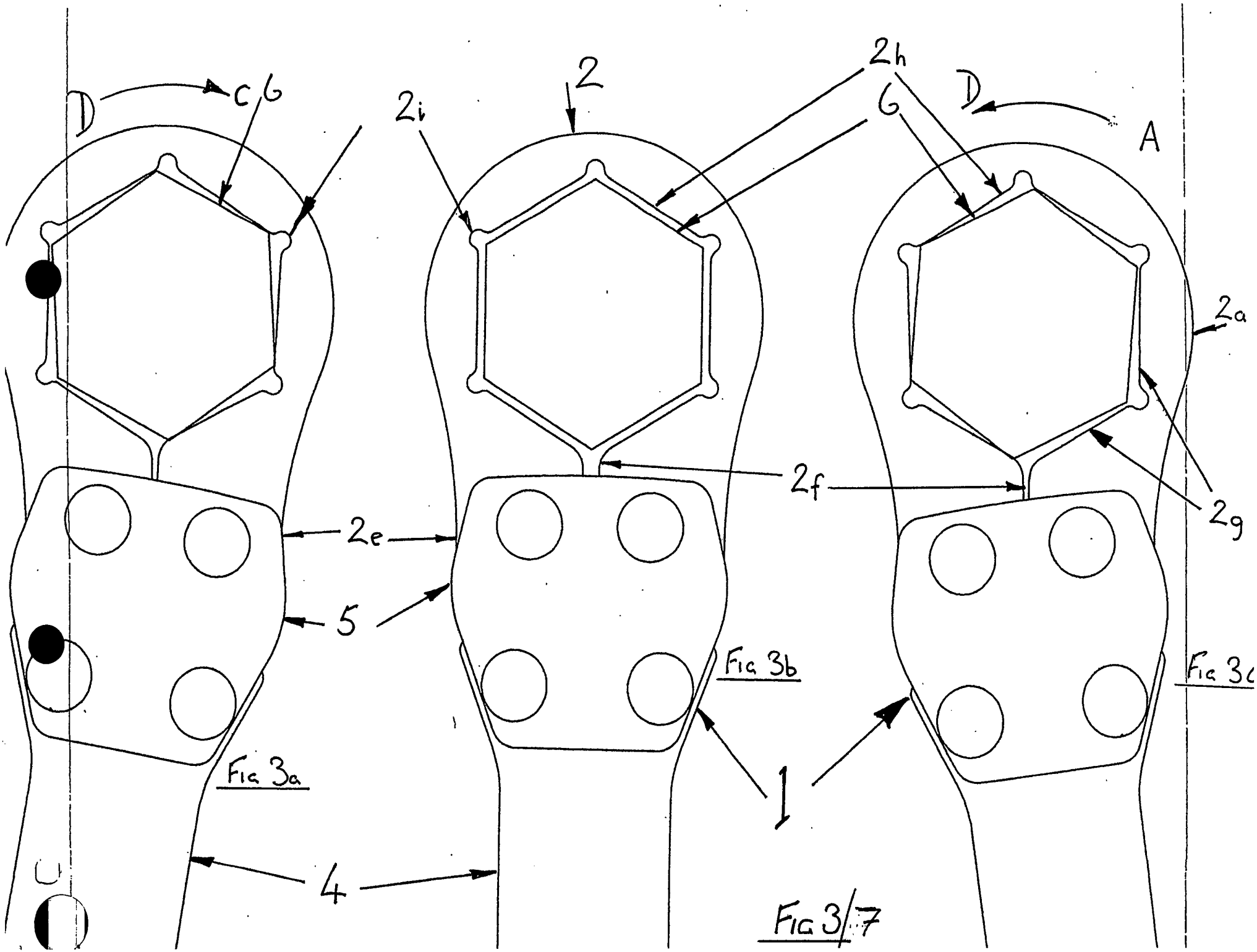


Fig 3a

Fig 3b

Fig 3c

Fig 3/7

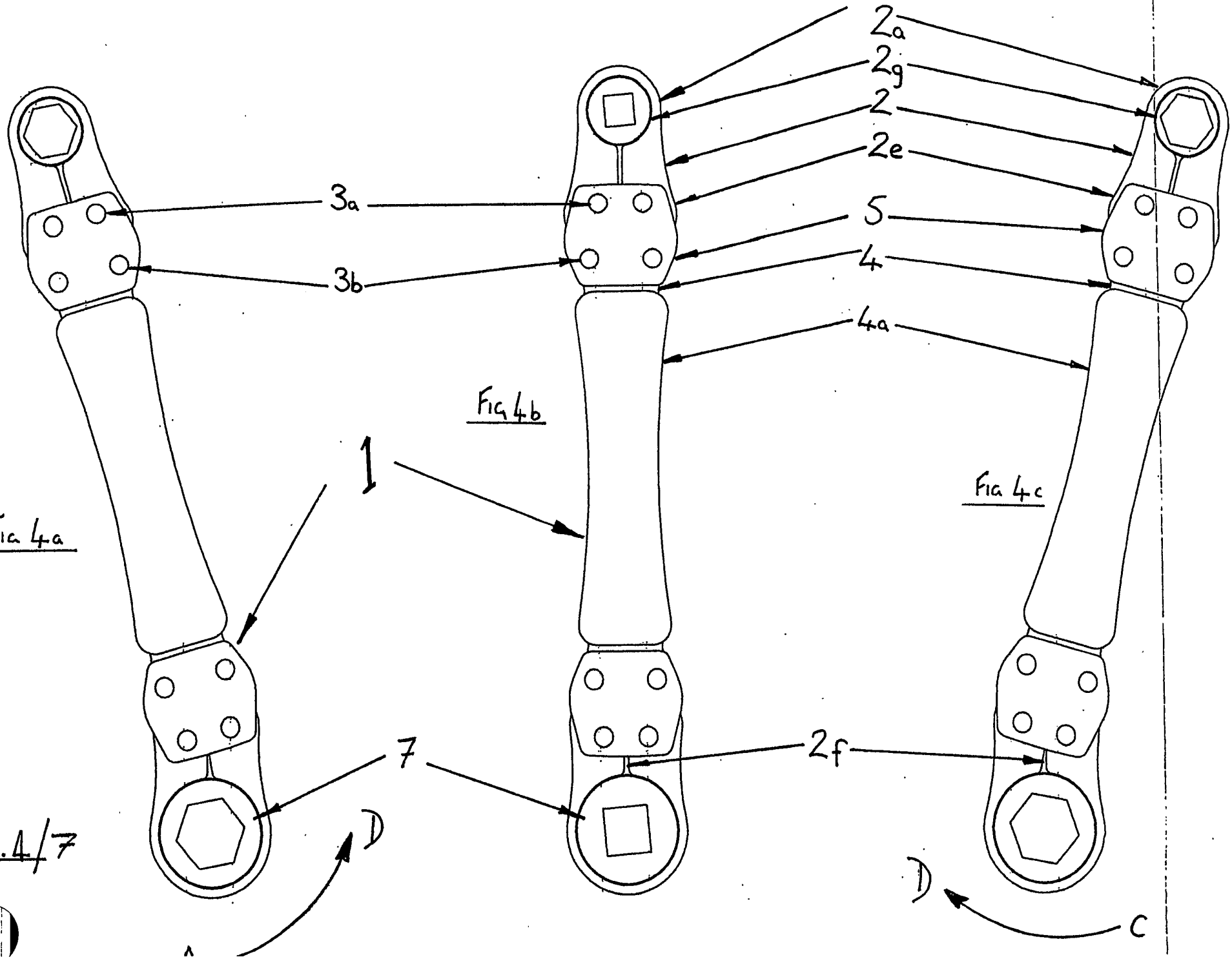


Fig 4a

Fig 4b

Fig 4c

Fig. 4/7

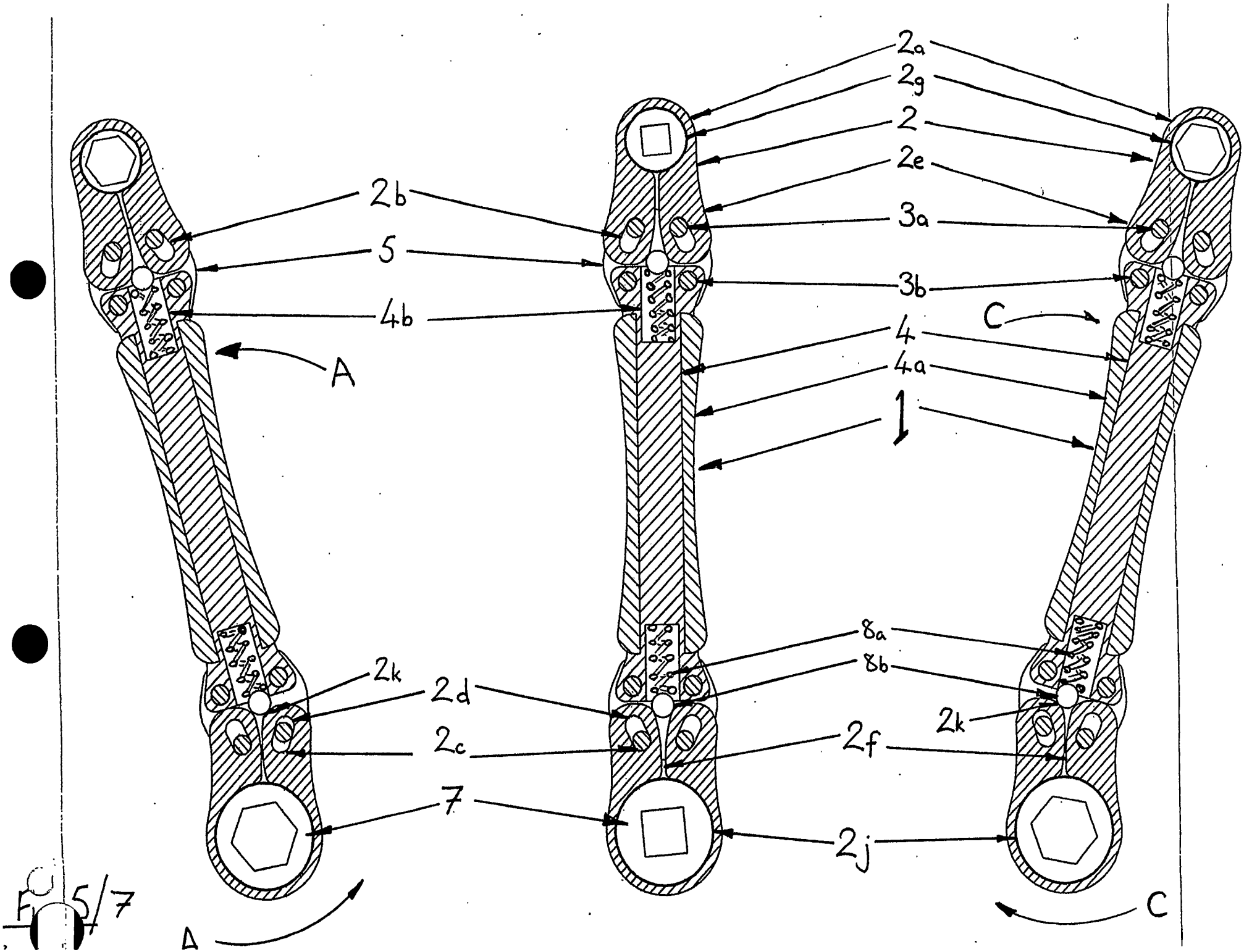


Fig 5/7

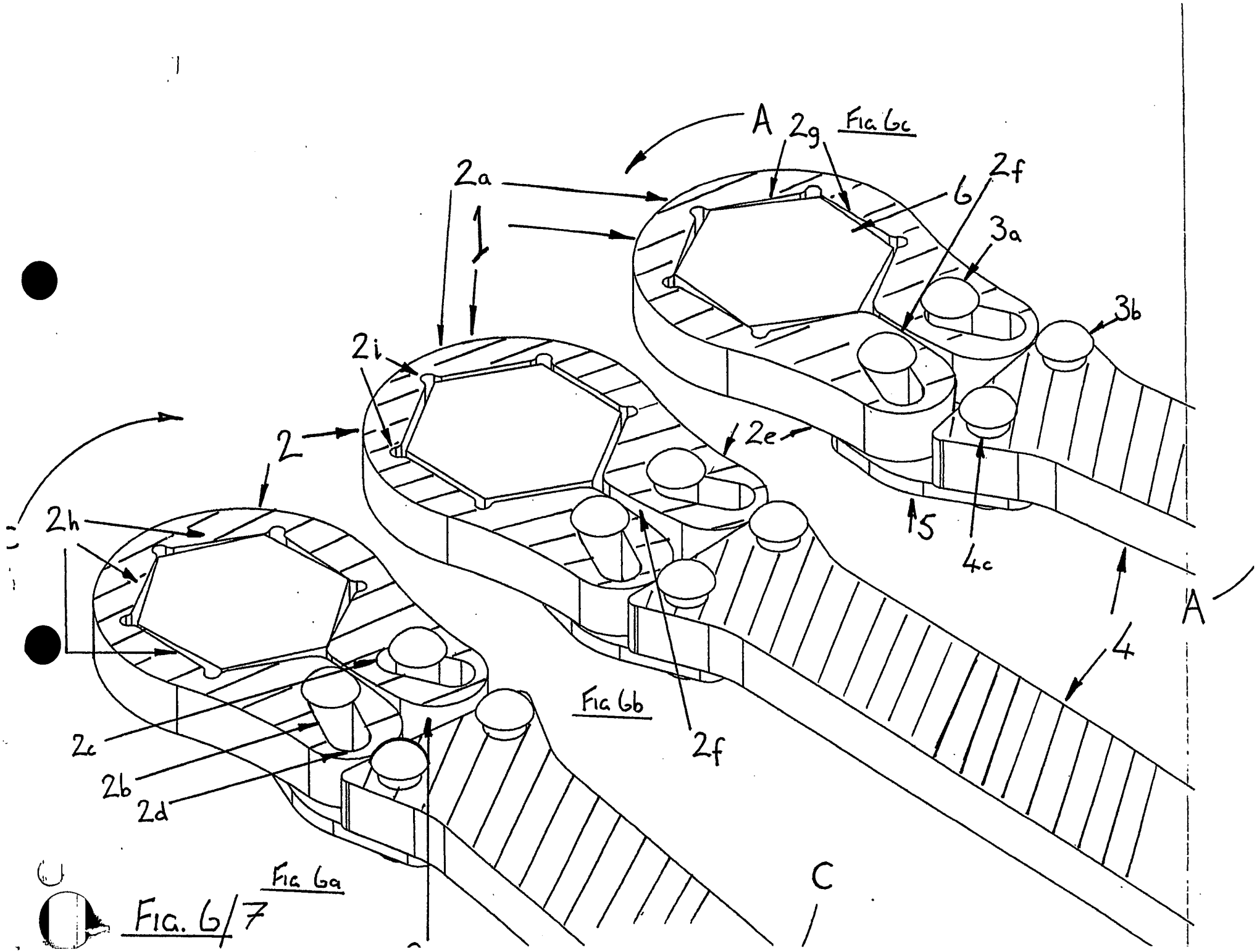


Fig. 6/7

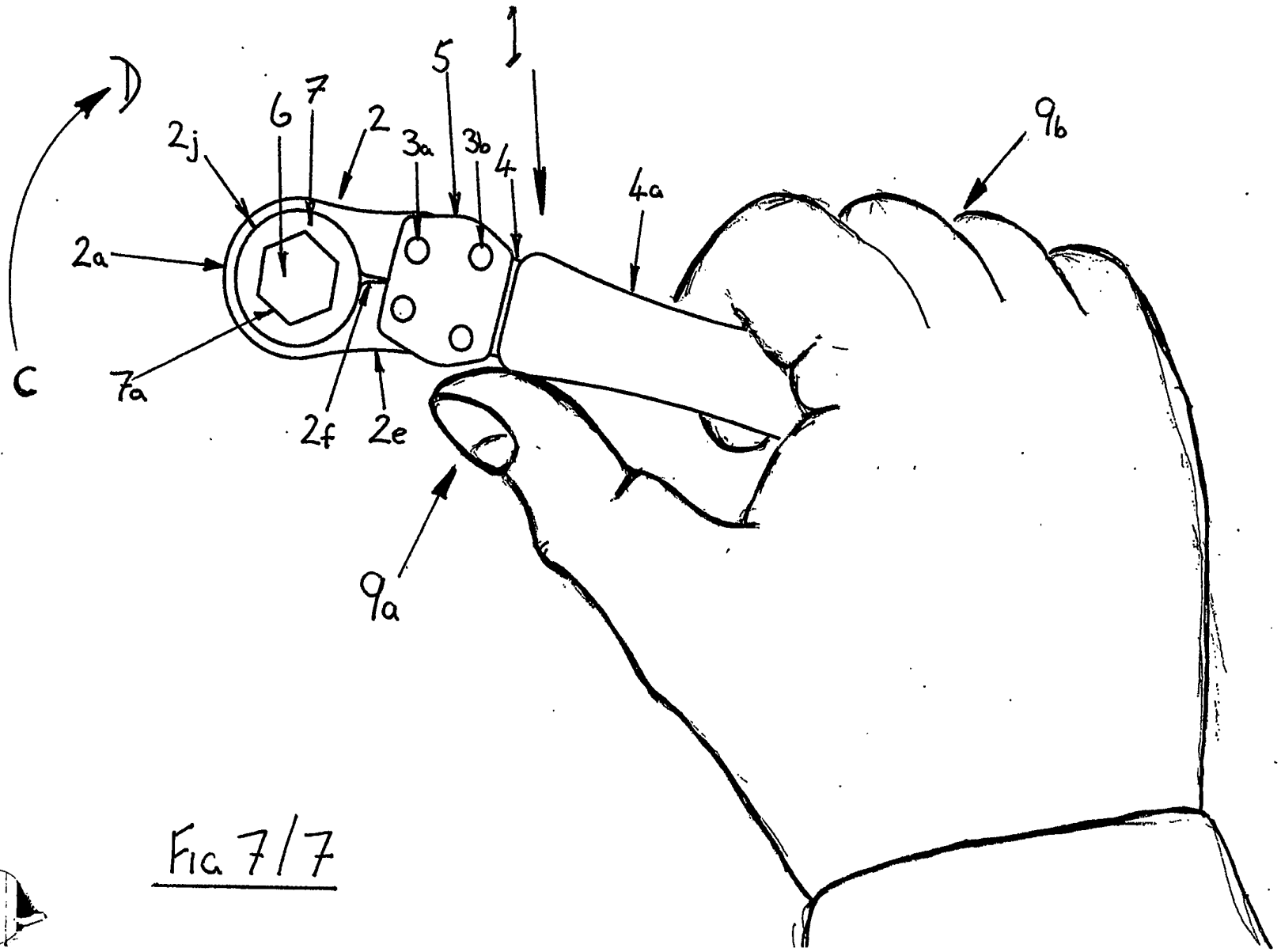


Fig 7/7